

REMARKS

This amendment responds to a non-final Office Action dated July 30, 2003, in the above-identified patent application. By this response, independent claims 1 and 20 have been amended. Claims 1-8, 12 and 20-22 are under consideration in the application, of which claims 1, 20 and 22 are in independent form. No claims are currently allowed. This Response is being filed within three months of the Office Action outstanding. No fees are required.

In the Office Action dated July 30, 2003, the Examiner rejects Applicants claims 1-4 and 21-22 under 35 U.S.C. 102(b) as being allegedly being anticipated by Zhang et al. (U.S. Patent 5,569,610) (hereinafter "Zhang"). Applicants will address each of independent claims 1 and 22 in turn.

Applicants' independent claim 1 recites "depositing an amorphous silicon film on the substrate by the process of physical vapor deposition" and then the separate step of "introducing a metal catalyst to the amorphous silicon film." Applicants have amended claim 1 to more clearly recite that Applicants' process is a two step process, namely, by this Response Applicants have amended claim 1 to recite "introducing a metal catalyst to the previously deposited amorphous silicon film." (emphasis

added). This two step process is not taught or suggested by the cited prior art.

In a first step, the use of physical vapor deposition (PVD) to form the amorphous silicon layer is claimed. As recited by Applicants in numerous locations throughout the patent application, the use of PVD to form the amorphous silicon film gives unexpected and beneficial results over amorphous silicon films formed by CVD. In particular, Applicants refer the Examiner to the detailed description portion of their specification at page 18, line 10, through page 19, line 5:

"The process of producing the PVD-Si precursor film and the film's physical properties will now be described. The [amorphous silicon] a-Si precursor of the present invention is an a-Si film deposited using physical vapor deposition (PVD). In other words, PVD technology is utilized for the formation of the thin silicon film that is used as the active layer of the TFT device. This type of silicon material is very difficult to crystallize by [solid phase crystallization] SPC alone, due to the way in which the film is deposited. When silicon is sputtered, two phenomena occur which relate to the physical properties of the film. First, silicon atoms arrive on the surface of the forming films having a higher energy than in relevant, chemical deposition methods. This energy is imparted to the film creating collision cascades and resulting in structural damage to the film. This structural damage is similar to the damage experienced by a film subjected to ion implantation. However, the amount of damage to the film during PVD is lower than during ion implantation due to the lower energy of the arriving silicon species during PVD. Second, energetic neutral atoms of the plasma

forming gas reflected from the target reach the film and also impart their energy and contribute to the structural changes in the film. As a result of these two phenomena, the structural disorder in the film increases, making it particularly difficult to form stable nuclei and commence solid phase crystalline growth when the film is subjected to a thermal anneal. Surprisingly, however, the structural disorder in the film does not prohibit crystallization by the method of metal induced crystallization." (emphasis added).

In a second, separate step, the metal catalyst is introduced to the "previously deposited amorphous silicon film." (emphasis added). Applicants' two step process, wherein the amorphous silicon film is initially formed without having catalytic material formed therein, is important due to utilization of a barrier layer later in the process to form windows. Specifically, the catalytic material may be subsequently added to the amorphous silicon film in selected regions, as recited in Applicants' dependent claim 12 and independent claim 22. None of the references cited by the Examiner teach, first, "depositing an amorphous silicon film on the substrate by the process of physical vapor deposition" and then, second, a separate step of "introducing a metal catalyst to the previously deposited amorphous silicon film."

The Examiner's rejection of Applicants' claim 1 incorrectly characterizes the prior art and is an improper use of hindsight. In particular, the Examiner states that

the Zhang reference teaches "depositing an amorphous silicon film (FIG. 1A, 12) on the substrate by the process of physical vapor deposition (col. 2, line 65 to col. 3, line 10)" and then "introducing a metal catalyst to the amorphous silicon film (col. 3, lines 54-66 and col. 6, lines 54-64)." The Examiner's assertion that Zhang teaches a two step process is incorrect.

Each of Zhang's four examples recite forming an amorphous silicon film by low pressure chemical vapor deposition (LPCVD), a very different process than Applicants' process utilizing physical vapor deposition (PVD). Zhang mentions physical vapor deposition (PVD) in only one sentence. At column 2, line 67 through column 3, line 2, Zhang states "When the amorphous silicon film is formed by physical vapor deposition such as sputtering, the catalytic material may be added to the target or evaporation source for forming a film." This single sentence of Zhang teaches a single step where the amorphous silicon film and the metal catalytic material are formed together in a single step by the process of physical vapor deposition. (The catalytic material is "added to the target or evaporation source." col. 3, line 2). Zhang does not mention or suggest any benefits of a two step process wherein the a-Si film is first formed by PVD and then a metal catalyst is introduced to the previously formed

silicon film. In fact, Zhang teaches away from a two step process because the one step PVD process of Zhang is conducted more quickly.

In summary, the Examiner has modified the teachings of Zhang by stating that Zhang teaches first "depositing an amorphous silicon film on the substrate by the process of physical vapor deposition" and then a second, separate step of "introducing a metal catalyst to the previously deposited amorphous silicon film." However, Zhang does not teach or suggest a two step process. Accordingly, Zhang does not teach or suggest Applicants' two step method as recited in claim 1 as amended and Applicants respectfully request allowance of independent claim 1, and corresponding dependent claims 2-4 and 21 under 35 USC 102(b).

Similar to claim 1, Applicants' independent claim 22 recites a two step process: "depositing an amorphous silicon film on the substrate by the process of physical vapor deposition; after deposition of said amorphous silicon film, depositing a metal catalyst film on selected regions of the amorphous silicon film." (emphasis added). As recited above with respect to claim 1, Zhang does not teach or suggest a two step process wherein an amorphous silicon film is deposited by physical vapor deposition and then, in a separate step, "after deposition of said

amorphous silicon film, depositing a metal catalyst film on selected regions of the amorphous silicon film." Accordingly, Applicants respectfully request allowance of independent claim 22 under 35 USC 102(b).

Moreover, Applicants' claim 22 recites "depositing a metal catalyst film on selected regions of the amorphous silicon film." (emphasis added). None of the cited references teach or suggest depositing a metal catalyst film on selected region of an amorphous silicon film that has previously been deposited by PVD. For this separate reason, Applicants respectfully request allowance of independent claim 22 under 35 USC 102(b).

In the Office Action dated July 30, 2003, the Examiner rejects Applicants dependent claims 5-8, 12 (as applied to independent claim 1 above) and independent claim 20 under 35 U.S.C. 103(a) as being allegedly being unpatentable over Zhang and further in view of Venkatesan et al. (U.S. Patent 5,371,382) (hereinafter "Venkatesan") and Applicants' Admitted Prior Art (hereinafter "AAPA"). Applicants will address each of independent claims 1 and 20 in turn.

With respect to claim 1, as stated above, Zhang does not teach or suggest Applicants' two step process as recited in Applicants' independent claim 1 as amended: "depositing an amorphous silicon film on the substrate by

the process of physical vapor deposition" and then the separate step of "introducing a metal catalyst to the previously deposited amorphous silicon film." (emphasis added).

The Venkatesan et al. reference does not teach or suggest a two step process of "depositing an amorphous silicon film on the substrate by the process of physical vapor deposition" and then a separate step of "introducing a metal catalyst to the previously deposited amorphous silicon film." Venkatesan does not even teach or suggest introducing a metal catalyst to an amorphous silicon film. In particular, Venkatesan is directed toward doping using Boron and Arsenic to create a rectifying contact. Venkatesan is not concerned with exploiting different crystallization speeds between a catalyzed region and a non-catalyzed region. One skilled in the art would not look to Venkatesan's method of creating a rectifying contact using "dopants" which remain in the film, in order to improve a method of reducing crystallization by solid phase crystallization using a metal "catalyst" that preferably is completely depleted. Moreover, Venkatesan teaches a one step process wherein the Boron and Arsenic dopants are sputtered in a single step with the silicon. ("Sputter deposited B-doped and As-doped amorphous silicon

contacts about 2000 Angstroms thick were formed on the natural I Ib diamond samples." col. 6, lines 5-17).

Applicants' Background section does not address a PVD process. Moreover, Applicants Background section does not teach or suggest a two step process including "introducing a metal catalyst to the previously deposited amorphous silicon film," wherein the previously deposited amorphous silicon film was deposited by PVD. As recited above, Applicants' detailed description section at pages 18 and 19, not Applicants' Background section, recites the unexpected benefits of utilizing a PVD deposited a-Si film, instead of a CVD film, in the two process as claimed. Accordingly, the only suggestion of the benefits of the combination of a PVD process with a subsequent step of introducing a metal catalyst to the previously deposited amorphous silicon film comes from Applicants' detailed description and not from any admitted prior art.

In summary, the Examiner has modified the teachings of Zhang by stating that Zhang teaches first "depositing an amorphous silicon film on the substrate by the process of physical vapor deposition" and then a second, separate step of "introducing a metal catalyst to the amorphous silicon film." However, Zhang does not teach or suggest a two-step PVD process wherein a catalyst is added to the previously deposited PVD silicon film.

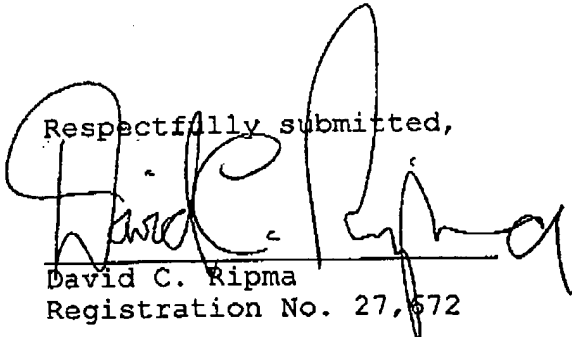
Venkatsan does not teach or suggest "introducing a metal catalyst to the amorphous silicon film" but instead teaches dopants that are formed simultaneously within the film in a single step. Accordingly, even if the steps from Venkatsan's very different process are combined with Zhang, Venkatesan also teaches a single step wherein the Boron and Arsenic are deposited together with the amorphous silicon. Applicants' Background section only discusses CVD deposited films and does not even address a PVD process. There is no teaching or suggestion whatsoever in any of the cited references of depositing an amorphous silicon film on a substrate by PVD and then, in a separate step, introducing a metal catalyst to the previously formed amorphous silicon film. Accordingly, none of the three cited references teach or suggest Applicants' two step method as recited in claim 1 as amended and Applicants respectfully request allowance of dependent claims 5-8 and 12 under 35 USC 103(a).

Applicants' independent claim 20 as amended recites "depositing an amorphous silicon film on the substrate by the process of physical vapor deposition" and then "in a separate step from the deposition of said amorphous silicon film, depositing a metal catalyst film on the amorphous silicon film." (emphasis added). As recited above with respect to Applicants' claim 1 as amended, none

of the three cited references teach or suggest Applicants' two step process as recited in claim 20 as amended and Applicants respectfully request allowance of independent claim 20 under 35 USC 103(a).

Applicants respectfully request entry of this Amendment and reconsideration of the application as amended.

Respectfully submitted,



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